INTERIM

PROGRAM OF STUDIES

BIOLOGY

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GOALS AND OBJECTIVES

Goal 1
Foundation of Knowledge in the Natural Sciences

Objectives:

1.1 know some of the fundamental ideas of biological science

- 1.1.1 interdependence of living organisms with one another and with the environment
- 1.1.2 uniqueness, diversity and changing nature of life forms
- 1.1.3 continuity of life forms
- 1.1.4 life processes regulate and maintain living systems
- 1.1.5 conservation of energy and matter in living systems
- 1.1.6 humans are unique in their responsibility for and impact upon living systems

1.2 view such knowledge as part of a systematic explanation of natural phenomena

1.3 use the knowledge learned, when interpreting natural phenomena.

Goal 2
Nature of Science

Objectives:

2.1 understand that science is a disciplined way to develop explanations for the events and objectives of the natural world

- 2.1.1 empirical data plays an central role in the development of scientific knowledge
- 2.1.2 scientific explanations are developed through interpretations and conceptual inventions which are theoretical in nature
- 2.1.3 theories may subsequently be supported or refuted by the results of experimentation

2.2 develop skill in the processes of science: questioning, acquiring data, proposing ideas, designing experiments, gathering, processing, and interpreting data into a unified theory

2.3 recognize that scientific knowledge is cumulative and subject to change.

Goal 3
Science and Technology

Objectives:

3.1 view technology as a means of solving practical problems

3.2 know that the scope of technological development includes both techniques and products

3.3 use scientific knowledge to explain and understand technological devices

3.4 know that science can be used to advance technology and that technology can be used to advance science

3.5 become familiar with some of the existing and emerging technologies.

Goal 4
Science, Technology, Society

Objectives:

4.1 understand that science and technology influence and are influenced by societal issues

4.2 understand that many of the effects of science and technology on society are unforeseen

4.3 become aware of the interaction of science and technology with societal factors such as economic, political, ethical and moral forces

4.4 appreciate the societal impact of technological processes, techniques and products

4.5 be aware that trade-offs are made in order to arrive at workable circumstances involving science and technology in society

4.6 evaluate the appropriateness of various societal decisions in terms of related scientific and technological thinking

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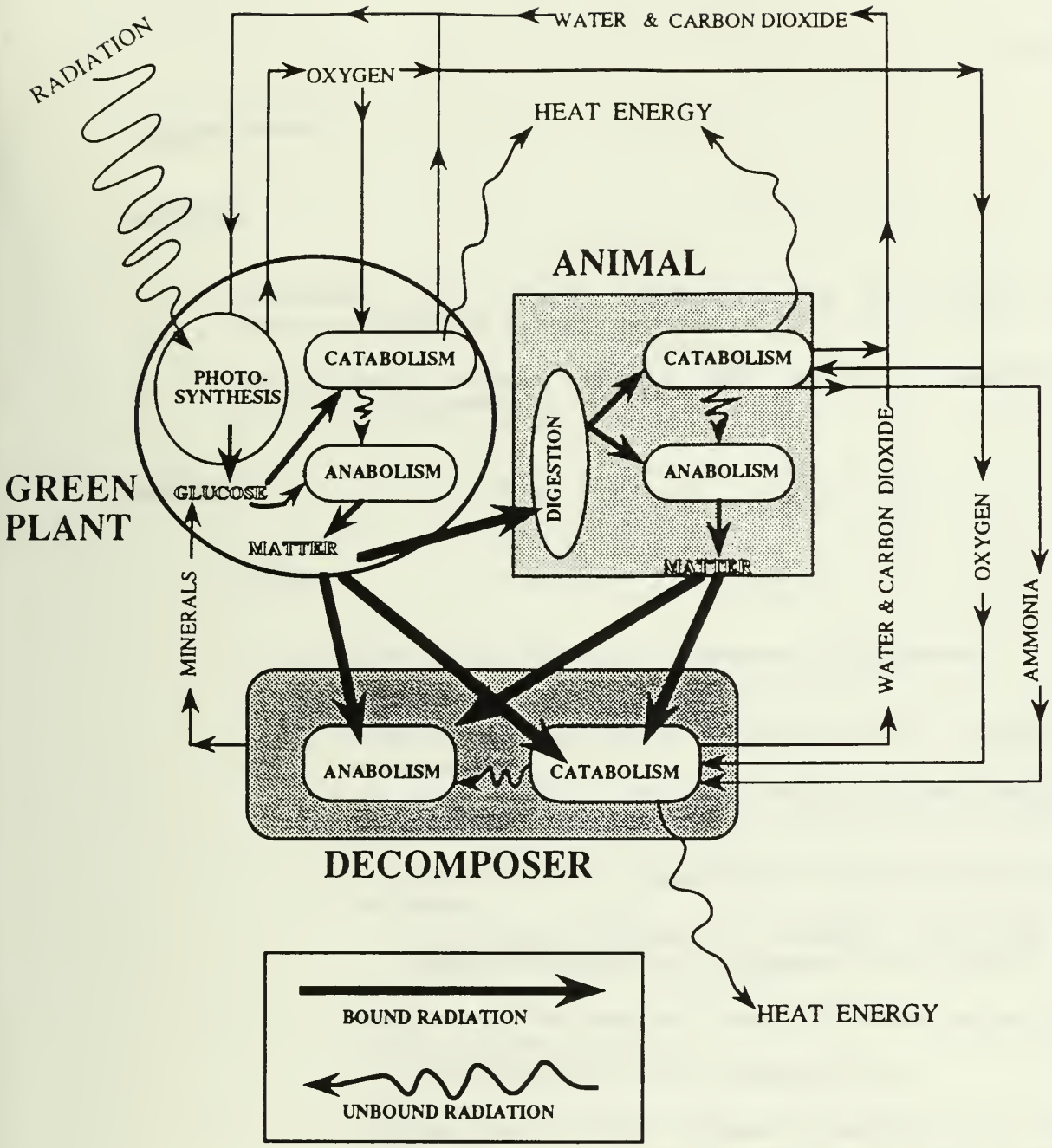
RADIATION
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ECOSYSTEM

UNIT I: ECOLOGY

OVERVIEW:

The emphasis of this unit is on ecological principles and the unique influence of humans and technology on the environment.

Field trip and/or laboratory experience should lead to an understanding of the presented model of an ecosystem.

CONTENT:

Concepts

1. Biosphere is the result of a unique set of circumstances (as far as we know).

C a. Understand that the biosphere has evolved from the interactions of biotic and abiotic factors.
Include a study of biotic and abiotic factors and changes that have occurred in the biosphere.

K b. Know that the sun is the ultimate source of the energy which flows through the biosphere.
The underlying principle to be discussed is that energy cannot be created or destroyed but it can be converted to various forms.

S c. Design models that show that matter is constantly recycled through the biosphere (geochemical cycles).
Study cycling of H_2O, C, O_2, N, optional Ca, P, Fe.

C d. Understand the relationship between photosynthesis and respiration as pivotal processes in the flow of energy and cycling of matter in the biosphere.
General discussion of role of pigments, particularly chlorophyll, in photosynthesis is required. A simplified treatment of the light and dark reactions of photosynthesis that shows splitting of water molecules and subsequent release of O_2, and use of ATP and H^+ along with CO_2 to produce glucose in dark reactions, is the minimum required.

2. Biomes are seen as components of the biosphere.

C a. Identify the abiotic factors which define a particular biome.
Temperature, moisture, light, nutrients and wind largely determine distribution of vegetation.

Ap b. Apply your knowledge of abiotic factors to determine the particular flora and fauna which characterize a biome.
Climatographs are useful in comparing one region with another.

C c. Recognize that biomes change over time.

C d. Understand that technology enables people to alter biomes.
Examples: agricultural and forestry practices, mining, power production.

S e. By studying a Canadian biome, integrate the subconcepts developed in a. to d.

3. Ecosystems are components of biomes in which organisms interact with biotic and abiotic factors.

C a. Understand that energy flows and matter cycles through trophic levels (producers, consumers and decomposers).
Parallels between aquatic and terrestrial ecosystems should be noted.

An b. Recognize that food chains, food webs and food pyramids show nutritional relationships within the ecosystem.
Energy and mass pyramids should be discussed.

C c. Understand that special symbiotic relationships occur within ecological communities.
Examples of mutualism, commensalism and parasitism should be studied.

C d. Understand that competition for resources occurs within an ecosystem.
Discuss both inter- and intraspecific competition for space and nutrients.

C e. Interpret the competitive exclusion principle that states that no two species can occupy the same niche.
Define species, niche.

An f. Recognize that the ecosystem exists in a state of dynamic balance and that this equilibrium may be altered by natural forces and human activity.
Discuss succession and influemces on succession such as fire, lumbering, grazing and browsing, cultivation, industrialization and urbanization.

E g. Using the scientific process, investigate ecological relationships in a laboratory and/or field setting.
The student must study a real or created ecosystem.

E h. Design and/or interpret a model of the ecosystem which integrates the concepts of energy flowing and matter cycling through trophic levels.
Model included.

4. Abiotic and biotic factors influence the dynamics of open and closed populations.

C a. Understand that closed populations are influenced by a variety of factors.
Some of the factors to be studied include natality, mortality, space, food, territoriality, disease and waste accumulation.

C b. Understand that open populations are influenced by a greater variety of factors than closed populations.
Additional factors which influence open populations include immigration, emigration, competition and predation.

Ap c. Apply graphing skills to depict population growth patterns and density.

Students should be able to graph real or hypothetical data and understand the patterns shown by the graphed information.
(example: S curve).

An d. Analyze population data and clearly communicate the interpretation(s) and conclusion(s).

5. Society and technology provide additional influence on the dynamics of human populations.

C a. Identify societal and technological factors which influence the human population.

An b. Analyze the data for human population growth in the last 10,000 years.

E c. Evaluate the theory of human population growth as presented by Thomas Malthus.

E d. Using a specific case of human population growth, evaluate the influence of societal and technological factors.
Factors which may be included are economic, ethical, medical and political.

Skills:

1. Research and communicate information using a variety of techniques.
   (examples: essays, mapping, graphing, posters, diagramming, A-V presentation)

2. Utilize process skills in an ecological laboratory and/or field study situation.

3. Generalize the ecosystem model to other levels of ecological organization (biosphere, biome).

4. Demonstrate skills in graphing, calculating and predicting from populations data.

5. Evaluate all aspects of an ecological issue and formulate an informed opinion.

6. Identify modes of possible personal action regarding ecological issues.
   (examples: letter to members of parliament, personal example, political involvement, economic support, consumer choice)

Attitudes:

1. Appreciate the environment and its complexity.

2. Question information regarding environmental issues.

3. Develop an awareness of his or her personal role in preservation of the balance of nature.

4. Develop optimism in regards to the human ability to function within the balance of nature.

5. Appreciate the responsibility of the individual regarding ecological issues.

UNIT II: CHANGE AND CONTINUITY

OVERVIEW:

This unit attempts to show a balance between the continuity of life and its change over time.

The emphasis of this unit is on understanding genetic principles and applying methods to predict genetic probabilities.

Discussion and evaluation of present technologies should lead to an awareness of genetic issues in society.

CONTENT:

Concepts

1. The cell is the unit of the structure and function of life.

C a. Observe and identify cell structures that are visible using the light microscope.
Exercise caution regarding the body fluid policy when choosing the cells for observation. Cell structures to be studied include cell membrane, nucleus, cell wall, cytoplasm, vacuole and chloroplast.

C b. Identify the function of each observed cell structure.

2. Mitosis and meiosis are cellular processes which are important in the continuity of life.

K a. Define the structures involved in cellular reproduction.
The structures to be studied include the centriole, nucleus, nuclear membrane and chromosome.

An b. Differentiate between the processes of mitosis and meiosis and understand the purpose of each process.

C/An c. Identify the phases of mitosis and recognize that meiosis, which results in gamete formation, is a transition from mitosis.

C d. Realize that abnormal cell division may result in disease.
Optional application may include a study of Down's syndrome, Turner's syndrome and cancer.

E e. Recognize that technology enables the detection of genetic disorders and be aware of the ethical problems created by the use of this technology.

Amniocentesis and the test for Huntington's disease may be used as examples of technology in this area. Optional examples may include the PKU test and analysis of fetal blood.

3. DNA has unique characteristics that are essential to life.

Ap a. Describe the structure and replication of a molecule of DNA with reference to the model developed by Watson and Crick.

S b. Understand that proteins are synthesized from information stored in the DNA molecule.

Students should understand that protein synthesis occurs in ribosomes. An understanding of how m-RNA and t-RNA operate to sequence amino acids is also required. Knowledge of the base sequences that specify particular amino acids is not necessary.

K/Ap c. Know that mutations arise from changes in the DNA or RNA molecule and be aware of some of the factors that induce these changes.

Factors that induce mutations include heat, radiation and chemicals.

C d. Understand how manipulation of the DNA molecule results in genetic engineering.

A definition of genetic engineering and recombinant DNA is necessary. Application of the principles of recombinant DNA to an example such as the making of human insulin is recommended.

4. Principles of heredity are based upon predictable results.

C a. Understand the historical development of Mendel's principles.

Ap b. Apply Mendel's principles to monohybrid and dihybrid crosses.

Determination of sex should be utilized as one example of a monohybrid cross.

Ap c. Apply further genetic principles to incomplete dominance, sex linkage and multiple allele situations.

★ (extension: historical development of linkage theory, crossing over, chromosome mapping)

An ★ d. Recognize that many current varieties of plants and animals are the result of applied genetics.

(examples: agriculture, forestry, fisheries)

An ★ e. Understand how predictable ratios enable humans to make informed decisions in relation to genetic matters.

A discussion of genetic counselling in relation to genetic matters such as Rh incompatibility, sickle-cell anemia and cystic fibrosis is required.

5. Evolution of a species is affected by genetic variability and natural selection.

An a. Compare the evolutionary theories of Darwin and Lamarck.

E b. Evaluate Darwin and Lamarck's theories in view of evidence presented (past -> present)
(examples: geological, anatomical, phylogenetic, ontological, DNA analysis)

S c. Hypothesize how the theory of natural selection might have led to the variety of the organisms in the biosphere.

S ★ d. Identify modern revisions to Darwin's theory of evolution.

Skills:

1. Refine observational skills by use of the microscope.
2. Reinforce the concept of models as a thinking tool.
3. Apply principles of probability to the study of genetics.
4. Recognize the role of theories in the scientific method.
5. Apply the principles of genetics to one's role in society.

Attitudes:

1. Appreciate ethical dilemmas that may arise from the application of scientific research and/or technological developments.
2. Appreciate the historical development of scientific theories.
3. Be aware of the dynamics of scientific theories.
4. Appreciate how knowledge of genetic probability may affect human reproduction.

UNIT I: MOLECULES TO CELLS

OVERVIEW:

This unit establishes the foundation necessary for understanding the structure and function of the human body.

Important biological molecules are introduced and identified in the laboratory.

The model of the cell introduced in Biology 20 is expanded.

CONTENT:

Concepts

1. Certain organic molecules are essential to life.

C a. Describe the characteristics of carbohydrates, lipids and proteins.

C b. Identify carbohydrates, lipids and proteins using appropriate laboratory procedures.
Benedict's test, Biuret test, Iodine test, Sudan IV and Translucence tests.

C c. Understand that vitamins are special organic molecules provided by the diet.

K d. Recognize the importance of some inorganic substances.
Include H_2O and mineral ions such as Na^+, K^+, Ca^{2+}, P^{3+}, Cl^-.

C e. Understand how enzymes as organic catalysts control chemical reactions in the body.

2. Cells function individually and together to maintain life.

S a. Derive the functions necessary for life.

K b. Identify the major organelles of eukaryotic cells and describe their function.
Include cell membrane, cytoplasm, ribosomes, E.R., mitochondria, lysosomes, vacuoles, chloroplasts, Golgi apparatus.

S c. Describe how viruses and prokaryotic cells differ in form and function from eukaryotic cells.

Skills:

1. Observe, measure, collect and interpret data while investigating organic molecules.
2. Use proper laboratory procedures.
3. Examine the evidence of the role of nutrition in personal health.
4. Utilize models to conceptualize the structure and function of enzymes.

Attitudes:

1. Develop a responsible attitude towards personal nutrition.
2. Accept the limits of the available technology in a high school laboratory.
3. Appreciate the value of models in understanding complex concepts.

UNIT II: DIGESTION AND TRANSPORTATION

OVERVIEW:

This unit emphasizes the structure and function of the digestive and circulatory systems.

Students will use laboratory skills to collect, analyze and interpret data related to human body processes.

Consideration of medical information and research should allow students to evaluate alternatives before making decisions concerning personal health.

CONTENT:

Concepts

1. Food must be broken down into smaller units to be utilized by the body.

C a. Understand that metabolism includes catabolism and anabolism.
Examples: dehydration synthesis and hydrolysis.

K b. Recognize that the process of digestion involves the mechanical and chemical breakdown of food.

Ap c. Apply concepts of diffusion, osmosis, and active transport to the movement of materials from the digestive tract into the circulatory system.
Materials moved should include vitamins, minerals, digestive products such as glucose, amino acids, fatty acids, and water, and alcohol.

K d. Know that the unabsorbed material is eliminated.

An e. Trace the pathway of food through the digestive tract, analyzing the secretions and/or processes responsible for digestion, absorption and elimination.
Secretions to be analyzed should include pepsinogen, HCl, salivary amylase, gastrin, pancreatic amylase, lipase, trypsinogen, dissaccharases, secretin and bile.

K f. Identify a variety of technological devices and/or processes associated with the digestive system.
Devices and/or processes that might be discussed include ulcer drugs, colostomies, stomach stapling and intestinal bypass surgery.

An g. Identify societal factors related to food and digestion and analyze the implications to society and the individual.
Present value on fitness and being thin should be discussed.

★ Possible elective units.

Politics of Food, Agricultural Practices, Additives and Allergies

2. The circulatory system transports nutrients, gases and wastes to and from cells.

S a. Formulate a hypothesis which attempts to explain the necessity for a circulatory system in large multicellular organisms.

K b. Trace the circulation of blood through the heart, arteries, veins and capillaries.

An c. Describe the relationship of structure to function in regards to efficient circulation.
Examples: arteries, veins, capillaries and heart.

C d. Recognize that the pacemaker, nerves and hormones control circulation.

3. The composition of blood facilities transport, exchange, protection and homeostasis.

K a. Identify the cellular and non-cellular components of blood.

C b. Understand the processes by which materials are transported to and exchanged between the blood vessels and surrounding cells.

C c. Describe how the lymphatic system complements the circulatory system with respect to fluid balance and immunity.

C d. Describe the processes of immune reactions including phagocytosis and antigen-antibody mechanisms.

K e. Describe the mechanism of blood clotting and recognize its protective value. Students are expected to discuss how platelets, thromboplastin, prothrombin, Ca^{2+}, thrombin, fibrinogen and fibrin contribute to blood clotting.

C f. Understand some of the homeostatic mechanisms responsible for the maintenance of pH, blood sugar and temperature.

Ap g. Explore the use of some biomedical techniques and devices associated with circulation.
Examples: artificial hearts and pacemakers, transplants, heart-lung machines, monitoring devices, angioplasty, drug therapy, transfusion technology and rejection research.

E ★ h. Evaluate the societal factors that affect research, development and application of biomedical techniques and devices.

★ Possible elective units.

Biotechnology, Additives and Allergies, Communicable Diseases, Cancer Research

Skills:

1. Demonstrate the techniques in using a sphygmomanometer and taking a pulse reading.
2. Gather, organize and evaluate information.
3. Apply information to formulate personal choices.
4. Examine and assess a variety of viewpoints on medical issues before forming an opinion.

Attitudes:

1. Realize that healthy organisms demonstrate a range of measurable values for body processes.
2. Appreciate that healthy human bodies exhibit several body types (somatotypes).
3. Appreciate the intricate workings and balance of the human body.

UNIT III: ENERGY METABOLISM

OVERVIEW:

This unit integrates the body processes of digestion, transportation, gas exchange and energy metabolism.

The process of cellular respiration will be studied by examining how oxygen is obtained and the waste carbon dioxide is eliminated, as well as how energy stored in the bonds of food molecules is converted to forms usable by the body.

CONTENT:

CONCEPT

1. The human body has an efficient system for gas exchange.

C a. Describe the structures through which a molecule of O_2 may pass as it moves from the external environment to the alveolus.

C b. Relate the structures of the respiratory system to their function.

C c. Realize that gas exchange occurs across a moist membrane and understand the role of hemoglobin and plasma in the transport of O_2 and CO_2.

An d. Analyze the effects of smoking on the respiratory system and discuss the implications of smoking to society.

★ Possible Electives - Lung Cancer, Death and Dying

2. The chemical energy of nutrients is released by successive reactions within the cell.

C a. Understand that energy is stored in chemical bonds.
Examples: ATP and glucose.

S b. Trace what happens to a molecule of glucose as it undergoes anaerobic and aerobic reactions by comparing the end products, the amount of ATP produced and where in the cell each series of reactions occurs.

K c. Recognize that nutrient molecules other than glucose may be used in the aerobic release of energy.
Examples: amino acids, fatty acids, glycerol and lactic acid.

d. Outline body processes which utilize ATP.
   Examples: muscular contraction and movement, transmission of nerve impulses, active transport, cellular reproduction and growth, phagocytosis.

3. Contraction and relaxation of muscles utilizes ATP.

K a. Identify the levels of organization within a skeletal muscle.

C b. Understand the roles of actin, myosin, ATP, creatine-phosphate and calcium in skeletal muscle contraction.

C c. Understand that continued vigorous muscular contraction may result in muscular fatigue due to oxygen debt.

An d. Differentiate between the properties of smooth, cardiac and skeletal muscles.

K e. Define "fitness" in terms of body form and function.

Skills:

1. Recognize the association between lifestyle and health.
2. Examine and implement the principles of fitness.
3. Refine the model of the ecosystem to incorporate energy and nutrient flow in the human body.

Attitudes:

1. Appreciate that we have choices in determining our personal environment.
2. Appreciate that all humans do not have equal choices in determining their personal environment.
3. Be aware of the complexity of human metabolism.
4. Realize that certain metabolic reactions are common to most organisms.

UNIT IV: HOMEOSTASIS

OVERVIEW:

This unit examines the dynamics of homeostasis.

The student will study the role of the kidney, nervous system and endocrine glands in the maintenance of body balance.

Students should realize the potentially harmful effects of drugs on this balance.

CONTENT:

CONCEPT

1. The kidney maintains homeostasis by a wide variety of processes.

C a. Understand that excretion is necessary to rid the body of metabolic wastes, excess materials and drugs.

K b. Identify the major components of the urinary system.

K c. Identify the major structures within the nephron and describe the processes associated with each.
The processes of force filtration, tubular secretion and absorption should be discussed.

Ap d. Explain how the kidney maintains homeostasis with reference to the following: water, Na^+ (ions), blood pressure, blood pH.

C/Ap e. Recognize that technology is important in advancing understanding in some of the following areas: kidney transplants, renal dialysis, treatment of kidney stones, drug and pregnancy testing.

2. The neuron is the unit of structure and function in nervous systems.

C a. Understand that the neuron is a cell specialized for the transmission of impulses.
Include a discussion of the components of a neuron (axon, dendrite, cell body, myelin and synapse) and how impulses are transmitted.

C b. Recognize that there are three types of neurons (sensory, motor, association) and understand how impulses are transmitted from one neuron to another.

Discuss components of reflex arcs, function of reflex action and synaptic transmission.

C c. Understand that the activation of motor neurons stimulates muscle contraction or glandular secretion.

Neuromuscular transmission should be discussed.

3. The human body monitors its internal and external environment through specialized sensory receptors.

a. Investigate the structure and function of the eye and explore some common disorders of the eye.

Dissection of a mammalian eye is recommended. Structures for study should include the cornea, iris, pupil, lens, retina, rods, cones, fovea centralis, sclera, choroid layer and auditory nerve. Disorders should include near sightedness, far sightedness, astigmatism, cataracts and glaucoma.

C/Ap b. Understand the structure and function of the ear and explore some ways in which the ear may be damaged.

Structures for study include eardrum, ossicles, vesibular apparatus including semicircular canals, cochlea including round and oval windows, cochlear fluid and organ of Corti, eustachian tube and auditory nerve.

C c. Understand that the body has receptors other than the eye and ear which respond to a variety of stimuli.
(examples: chemoreceptors, touch, taste, pain and temperature receptors)

Ap d. Realize that there are many technologies to improve perception.
(examples: corrective lens, surgical techniques, hearing aids)

4. The nervous system interprets information and coordinates responses.

K a. Understand that the brain and spinal cord comprise the central nervous system.

K b. Identify the major areas of the brain and describe their perceived role.

Include the cerebrum, cerebellum, medulla oblongata and hypothalmus.

Ap c. Explore the limits of our understanding of the brain.
Examples: CAT scan, EEG, EMR, thermography, brain mapping, biochemical research and therapy, behavioral studies.

K d. Know that the peripheral nervous system includes the afferent and efferent nervous systems.
Discuss how the efferent nervous system is subdivided into the somatic and autonomic (sympathetic and parasympathetic) nervous systems.

5. Endocrine secretions regulate and maintain body functions.

An a. Differentiate between endocrine and exocrine glands.

K b. Identify the major endocrine glands and describe their location in the body.
The major glands include pituitary, thyroid, parathyroid, adrenals, pancreas, ovaries and testes.

K c. Understand that endocrine glands secrete hormones which influence body functions.
Include functions of the following hormones: HGH, ADH, oxytocin, TSH, ACTH, LH, FSH, thyroxin, PTH, adrenalin, insulin, glucagon, estrogen, progesterone and testosterone.

Ap d. Realize that hormone levels fluctuate within normal ranges and that hyposecretion or hypersecretion may result in disorders.
Disorders include goitre, diabetes and dwarfism.

Ap e. Recognize that biotechnology allows the manipulation of hormone levels for beneficial or potentially harmful results.
Examples: insulin, steroid hormones and HGH.

Skills:

1. Refine observational skills.
2. Interpret data to formulate logical explanations.
3. Recognize the limits of science and technology.
4. Apply a previously formulated model to a new situation.

Attitudes:

1. Responsible attitude towards care of the eyes and ears.
2. Appreciate the potentially dangerous effects of steroids and other drugs.
3. Appreciate the intricate workings and balance of the human body.
4. Become aware that our knowledge of the function of the human brain is limited.

UNIT V: REPRODUCTION

OVERVIEW:

The process of human reproduction, associated biomedical technology and societal issues related to reproduction are addressed in this unit.

Student application of knowledge to personal decisions is emphasized.

CONTENT:

CONCEPT

1. The structure, development and functioning of the reproductive system is under the control of hormones.

K a. Know the major structures of the male reproductive system and be able to describe their functions.

C b. Understand the development of sperm and identify the steps in the formation of semen.

K c. Know the major structures of the female reproductive system and be able to describe their functions.

C d. Understand how the female reproductive cycle is controlled by hormones.

An e. Differentiate between primary and secondary sex characteristics and understand that secondary sex characteristics are influenced by hormones.

E f. Discuss sexually transmitted diseases and evaluate the societal and biomedical implications.

2. Fertilization, pregnancy and birth ensure the continuation of the human species.

C a. Understand the processes that result in fertilization.

K b. Realize that interactions between the mother's body and the developing embryo control pregnancy and birth.

Ap c. Explore some biomedical technologies related to fertility, fertilization, pregnancy and birth.

★ Suggested elective topics - Abortion, Birth Control, Amniocentesis and Genetic Counselling, Drugs, Death and Dying, In Vitro Fertilization

Skills:

1. Develop a personal responsibility for maintaining a healthy body.

2. Relate individual needs with societal concerns.

3. Apply the knowledge of biomedical technologies to personal lifestyle.

4. Examine and assess a variety of viewpoints on controversial issues before forming an opinion.

5. Develop the ability to critically examine evidence.
   (examples: statistics out of context, small sample, poor control, variables in living systems)

Attitudes:

1. Develop a responsible attitude toward reproduction and birth.

2. Appreciate the ethical dilemmas that may arise from the application of scientific research and/or technological developments.

ELECTIVE UNIT:

Suggested Time:
25 hours total

OVERVIEW:

In the elective unit the emphasis will be on the relationship of science, society and technology. This unit may be introduced where applicable, and ideally should reflect the interests of the students.

CONTENT:

Concepts

1. Issues develop because members of society have conflicting views.

An a. Investigate a variety of viewpoints on a selected issue.
Examine religious, economic, political and ethical viewpoints.

S b. Describe the historical background associated with the selected issue.

2. Science is regulated by the society in which it exists.

An a. Identify the scientific components of a selected issue.

E b. Understand how the scientific process may be affected by societal factors.

C c. Understand that science is an ongoing process, with future discoveries causing revision of today's decisions.

E d. Be aware of social and moral implications of scientific inquiry and its results.

3. Technology develops as a result of societal needs or wants.

An a. Identify the technology associated with a selected issue.

C b. Understand how science has contributed to the related technology.

C c. Understand how this technology has contributed to science.

4. Possible solutions for societal issues may be formulated by an analysis of a wide variety of contributing factors.

S a. Synthesize the information on a specific issue.

An b. Analyze the information on a specific issue.

S c. Formulate possible solution(s) which may resolve the issue.

E d. Evaluate the feasibility and consequences of the implementation of possible solution(s).

E e. Examine and evaluate possible avenues of action to help resolve the issue.

Skills:

1. Refine research skills.
2. Examine critically issue-related information and its source.
3. Demonstrate abilities to organize, evaluate, synthesize and communicate information.
4. Refine decision making skills.
5. Demonstrate an ability to take scientific, societal and technological factors into account when dealing with societal issues.

Attitudes:

1. Appreciate the relationship among science, technology and society in regards to social issues.
2. Appreciate the need for trade-offs in order to arrive at workable solutions.
3. Appreciate that the power to make decisions implies responsibility for the consequences.

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